

New methods for controlling and diagnosing hohlraum drive symmetry

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Efforts are underway to diagnose and control x-ray drive asymmetry on Nova hohlraums. Controlling time-integrated lowest order flux asymmetry P_2 on target in Nova is conventionally accomplished by displacing the laser beams outward or inward along the hohlraum symmetry axis. A novel method to control P_2 with fixed laser beams is to use a pair of axial gold discs of varying radii to partially block the laser-entrance-hole (LEH) from the view of the capsule. Some advantages in using axial discs include the prospect for added drive on target, the potential for P_4 control when used in tandem with laser pointing, and possibly reduced time-dependent flux asymmetry swings at early time. Neutron-based diagnostics have provided some suggestion of increased drive, but a more direct measure of drive enhancement on target is with use of backlit low-density (0.3 g/cc) foam balls. In this scheme, the ablatively-driven, inwardly propagating shock is tracked in time using backlighting from an irradiated Ti disc placed outside of the hohlraum. The benefit in using low-density surrogate targets is an amplified shock motion which enables easier detection of both average shock motion (drive) and distortion (flux asymmetry). Experiments and calculations are in excellent agreement over a nearly 20 eV enhancement in peak drive in the presence of axial gold discs. Measurements of lower distortion, P_2 and P_4 , versus time for several laser pointings using this technique have also been carried out showing good agreement between experiment and simulations. Efforts to further control time-dependent flux asymmetry using beam-phasing techniques on Nova, as will be required on the National Ignition Facility, are under development. Current designs indicate a nearly factor of three reduction in P_2 variations and significant control of time-integrated P_4 flux asymmetry with cone separation.

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